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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/616,606	07/14/2000	Douglas P. Hart	0050.2015-000	6151

959 7590 07/15/2004
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EXAMINER

HESSELTINE, RYAN J

ART UNIT PAPER NUMBER

2623

DATE MAILED: 07/15/2004

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/616,606

Applicant(s)

HART, DOUGLAS P.

Examiner

Ryan J Hesseltine

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 April 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2 and 5-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2 and 5-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 July 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on April 16, 2004 has been entered.

Response to Arguments

2. Applicant's arguments on page 6, paragraphs 2-5, filed April 16, 2004, with respect to Hsueh et al. have been fully considered and are persuasive. The 35 U.S.C. § 102(b) rejection of claims 1, 6, 7 and 9 has been withdrawn.

3. Applicant's arguments with respect to claims 1 and 7 have been considered but are moot in view of the new ground(s) of rejection.

4. Applicant's arguments on pages 7 and 8 filed April 16, 2004 have been fully considered but they are not persuasive. On page 7, last paragraph, applicant states, "Gharib does not disclose a system having a moveable aperture." The examiner respectfully disagrees. Gharib discloses an embodiment wherein a single camera may be used to obtain multiple exposures at different times by rotating a blocking element such that the blocking element is associated with different apertures at different times (column 3, line 56-column 4, line 13).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1, 2, 5-11, 13, 14, 16, 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsueh et al. ("Real-time 3D topography by speckle image correlation" cited on applicant's IDS), hereafter Hsueh, in view of Gharib et al. (USPN 6,278,847, previously cited), hereafter Gharib.

7. Regarding claims 1 and 7, Hsueh discloses an imaging system and method for imaging a target in three dimensions (abstract), the system and method comprising: a light projection source (laser speckle generator) for projecting a beam of light onto the target; an image acquisition subsystem (CCD cameras) for acquiring at least two images from light reflected by the target through a lens, an aperture element and a camera disposed along an optical axis (page 1, last paragraph to page 2, first paragraph); and a correlation processor for processing the acquired images according to a sparse array image correlation process (page 2, second paragraph). Hsueh does not disclose that the image acquisition subsystem comprises a moveable aperture.

8. Gharib discloses an aperture coded camera for three-dimensional imaging wherein the image acquisition subsystem further includes rotation means for rotating a moveable aperture element about the optical axis such that the at least two images are acquired sequentially from different angles (column 3, line 56 to column 4, line 13). It would have been obvious to one of ordinary skill in the art at the time the invention was made to sequentially acquire at least two images from different angles using a moveable aperture element including an opening offset from the optical axis as taught by Gharib in order to generate a three-dimensional model of an

object using a single camera without having to move the camera to different image capture positions by obtaining multiple exposures at different times (column 2, line 65-column 3, line 6).

9. Regarding claims 2 and 8, Gharib discloses that the image acquisition subsystem comprises a lens, an aperture element and a camera disposed along an optical axis (Figure 1C) and wherein the aperture element defines an opening offset from the optical axis (column 1, line 43-50) and the image acquisition subsystem further includes rotation means for rotating the aperture element about the optical axis (column 4, line 8-13) such that the at least two images are acquired sequentially from different angles (column 3, line 56-column 4, line 7).

10. Regarding claim 5, Gharib discloses that the image acquisition subsystem comprises a lens, an aperture element and a camera disposed along an optical axis and wherein the camera includes a single CCD element (Figure 1C; column 2, line 65-column 3, line 6).

11. Regarding claims 6 and 9, Hsueh discloses that the light projection source includes a diffuser for projecting a beam of light having a random pattern (page 1, last paragraph to page 2, first paragraph).

12. Regarding claims 10 and 16, in an imaging system having a lens, an aperture element and a camera disposed along an optical axis (inherent), Hsueh discloses an imaging method and system for imaging a target in three dimensions (abstract), the method and system comprising: a light projection source for projecting a beam of light onto the target; an image acquisition subsystem for acquiring at least a first and second image at the camera from light reflected by the target through the lens (page 1, last paragraph to page 2, first paragraph); and a correlation processor for processing the acquired images according to an image correlation process to resolve three dimensional components of the target (page 2, second paragraph). Hsueh does not

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disclose that the aperture element defines an opening offset from the optical axis and the image acquisition subsystem further includes rotation means for rotating the aperture element about the optical axis such that an opening of the aperture element offset from the optical axis is set to first and second positions and the at least two images are acquired at the CCD element sequentially from different angles. Gharib discloses an aperture coded camera for three-dimensional imaging wherein the aperture element includes an opening offset from the optical axis (column 1, line 43-50) and the image acquisition subsystem further includes rotation means for rotating the aperture element about the optical axis such that the at least two images are acquired sequentially from different angles (column 3, line 56-column 4, line 13; see above discussion of claims 1 and 7).

13. Regarding claim 11, Hsueh discloses that the processing includes processing the acquired images according to a sparse array image correlation process (page 2, second paragraph).

14. Regarding claims 13 and 18, Hsueh discloses that the processing further includes recursive (iterative) correlation (page 2, paragraphs 4-6).

15. Regarding claims 14 and 19, Hsueh discloses that the correlation processor provides correlation error correction (page 2, paragraphs 4-6).

16. Claims 12, 15, 17 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsueh in view of Gharib as applied to claims 11, 14 and 16 above, and further in view of Hart (USPN 5,850,485, cited on applicant's IDS).

17. Regarding claims 12 and 17, Hsueh discloses processing of the acquired images according to a sparse array image correlation process which comprises forming first and second image arrays of pixel values from respective first and second images, each pixel value associated

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with one of a number of pixels, and performing a correlation process on the selected pixel values comprising creating first and second sparse image arrays of the selected pixel values and their locations in the respective first and second image arrays, performing individual correlations successively between pixel entries of the first sparse image array and pixel entries of the second sparse image array within a pixel distance of each other, and cumulating the correlations in a correlation table at respective distance entries (page 2, second paragraph to last paragraph).

Hsueh does not explicitly disclose selecting pixel values in the image arrays which are beyond a pixel threshold value. Hart discloses sparse array image correlation wherein a threshold level is set and only the pixel values that exceed the threshold level are retained in a sparse image array (column 6, line 2-8). It would have been obvious to one of ordinary skill in the art at the time the invention was made to select pixel values in the image arrays beyond a pixel threshold value as taught by Hart in order to avoid processing pixels having a value below the threshold to speed overall processing (column 7, line 15-23).

18. Regarding claims 15 and 20, Hart discloses that the correlation processor provides sub-pixel resolution processing (column 5, line 42-54; column 8, line 61-65). It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide sub-pixel resolution processing as taught by Hart in order to improve accuracy while increasing processing speed (column 1, line 58-column 2, line 9).

Conclusion

19. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. USPN 6,298,259 to Kucharczyk et al. discloses a combined magnetic resonance imaging and magnetic stereotaxis surgical apparatus and processes wherein the magnetic

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resonance images are computed using recursive correlation.. USPN 6,313,910 to Garvey et al. discloses an apparatus for measurement of optical beams including a moveable assembly carrying multiple apertures. "Application of multiple model estimation to a recursive terrain height correlation system" to Mealy et al. "Design and implementation of on-body real-time depth map generation system" to Kagami et al.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ryan J Hesseltine whose telephone number is 703-306-4069. The examiner can normally be reached on Monday - Friday, 8:30 AM - 5 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on 703-308-6604. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Ryan J. Hesseltine
July 6, 2004

JINGGEWU
PRIMARY EXAMINER

